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Capital structure, product market competition and firm
performance: Evidence from South Africa

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Abstract

This paper investigates the relationship between capital structure and firm performance, paying particular attention to the degree of industry competition. The paper applies a novel measure of competition, the Boone indicator, to the leverage-performance relationship. Using panel data consisting of 257 South African firms over the period 1998 to 2009, this paper examines the effect of capital structure on firm performance and investigates the extent to which the relationship depends on the level of product market competition. The results suggest that financial leverage has a positive and significant effect on firm performance. It is also found that product market competition enhances the performance effect of leverage. The results are robust to alternative measures of competition and leverage.

JEL classification: G32; L11; L25

Keywords: Capital structure; Product market competition; Firm performance

1. Introduction

Despite several decades of research, there is no generally accepted conclusion about the relationship between capital structure and firm performance. Following

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the seminal papers of [Modigliani & Miller \(1958, 1963\)](#) suggesting that, but for the tax-advantage of debt, capital structure is irrelevant to firm performance, the relationship between financial leverage and firm performance has attracted much debate and mixed empirical findings. The trade-off between agency costs of debt and equity ([Jensen & Meckling, 1976](#)); the limited liability effect of debt ([Brander & Lewis, 1986](#)); and the disciplining effect of debt ([Grossman & Hart, 1983](#); [Jensen, 1986](#)) all suggest a positive effect of leverage on performance. However, possible underinvestment problems associated with debt ([Myers, 1977](#)) and stakeholder reactions to leverage ([Maksimovic & Titman, 1991](#); [Titman, 1984](#)) suggest negative effects. Extensions of these theories ([Bolton & Scharfstein, 1990](#); [Chevalier & Scharfstein, 1996](#); [Dasgupta & Titman, 1998](#)) suggest that leverage opens up opportunities for rivalry predation in concentrated product markets, thus conditioning the performance effect of leverage on the degree of competition in the product market. The existing evidence of these interaction effects of leverage and competition is based on U.S. firms ([Campello, 2003, 2006](#); [Chevalier, 1995a,b](#); [Kovenock & Phillips, 1997](#); [Opler & Titman, 1994](#)). The South African experience offers an opportunity to gain new insight. Distinct from the U.S., South Africa features a highly concentrated and pyramidal ownership structure of firms ([Barr et al., 1995](#); [Kantor, 1998](#)), overly concentrated product markets ([Fedderke et al., 2007](#)), and a less robust regulatory and legal environment ([Roberts, 2004, 2008](#)). These attributes suggest distinctively severe agency costs of equity and product market predation.

Using panel data consisting of 257 South African firms over the period 1998 to 2009, this study seeks to address three questions: (1) Does knowledge about product market competition improve our understanding of leverage-performance relationship in developing countries? (2) To what extent does this relationship hold or vary across alternative measures of competition? (3) To what extent do the effects of leverage on performance and its interaction with competition depend on rival firms' leverage levels?

The findings of this paper show a significant positive effect of leverage on firm performance. This effect is non-linear but remains significantly positive over the relevant range of leverage. It is also found that the interaction effect of leverage and competition on firm performance is positive. The findings imply that competition enhances the benefits of leverage. Using relative-to-rival firms' leverage yields consistent results.

These findings are broadly consistent with [Opler & Titman \(1994\)](#) and [Kovenock & Phillips \(1997\)](#) in respect of the adverse interaction effect of leverage and product market concentration (uncompetitiveness). However, these authors find statistically insignificant direct negative effects of leverage on firm performance, contrary to the

direct positive effects reported in this paper. The observed difference in the direct effect of leverage could be attributed to the nature and severity of agency costs of equity faced by South African firms.

This paper contributes to the existing literature in the following ways: first, by focusing on South African firms, the paper provides firsthand developing country evidence of the interaction effect of leverage and competition on performance. Given the unique characteristics of South African product markets, this paper provides evidence from a potentially highly predatory environment with severe agency costs of equity. To the author’s knowledge, this issue has not been previously addressed. Second, in addition to the Herfindahl-Hirschman Index, this study adopts a new measure of competition, the Boone indicator (Boone et al., 2005, 2007; Boone, 2008), which estimates the extent to which firms suffer lost earnings (or market share) as a result of being inefficient. The Boone indicator helps address potential setbacks in concentration indexes used in all previous studies (Opler & Titman, 1994; Chevalier, 1995a,b; Kovenock & Phillips, 1997; Campello, 2003, 2006). For instance, a high level of product market concentration could simply be the outcome of pronounced efficiency (Demsetz, 1973) or the exit of inefficient firms from the market as competition intensifies, in which case the profits of the more efficient firms increase (Boone et al., 2005, 2007; Boone, 2008).

The remainder of this paper is organised as follows. Section 2 provides brief motivation for the study of South African firms. Section 3 presents a review of the relevant theoretical literature and empirical evidence; whilst Section 4 outlines the research hypothesis. Section 5 describes the data and variables used for the study. Section 6 discusses the empirical estimation methods. Section 7 presents the empirical results. The summary and conclusion of the study are presented in Section 8.

2. South African corporate context

Concentrated and pyramidal ownership structures, as well as overly concentrated product markets, are some of the key features that distinguish South African firms from their U.S. counterparts. A considerably large proportion of Johannesburg Stock Exchange (JSE) listings are effectively controlled by groups with a pyramidal ownership structure.¹ Hence, South African firms are distinct from U.S. firms by way of the

¹For instance, almost 80% of JSE listings was controlled by groups in 1995 and this group structure has seen little change over time (Barr et al., 1995; Kantor, 1998). In fact, as at the end of 2002, 56.2% of the market capitalisation of JSE listings was controlled by four companies (see

agency problems they face. Conflict of interest is largely between minority and majority shareholders, rather than between managers and shareholder or creditors and shareholders as in the U.S. and U.K. (Barr et al., 1995; Kantor, 1998). In this agency relationship, the minority shareholders are the agents; the majority shareholders, the principals. As noted in Morck et al. (1998), such a system of ownership leads to an extreme level of expropriation of the minority shareholders since significant control rights can be exercised with little equity stake. This ownership structure, largely sustained by the tax advantage of equity investment, holding companies, cross-holding and voting trusts, has seen little change over time.² The agency problems associated with such a system of ownership may possibly be mitigated by the disciplinary measures embodied in debt contracts. Although debt financing comes with its own potential agency problems, with such a system of ownership the disciplinary measures embodied in debt contracts should logically be more desirable.

Although high levels of concentrated ownership, which have emerged from the pyramidal ownership structure (Ntim et al., 2012), may be associated with lower agency costs (Fama & Jensen, 1983; Villalonga & Amit, 2006), the robustness of the regulatory environment plays a major role (Anderson & Reeb, 2003). Compared to the U.S., regulatory quality is less robust in South Africa (Roberts, 2004, 2008), suggesting that the agency benefits of a concentrated ownership, relative to the associated agency costs, may be less. It is reasonable to suggest that the legal structures in South Africa may offer relatively less protection to investors, thus making the agency problems worse.

Another distinctive feature of South African firms is the degree of concentration in their product markets. Traditionally, South African firms are faced with a very high degree of concentration in market shares, which does not encourage competition. Using both firm level and aggregate industry data, Aghion et al. (2008) find that competition is relatively low in South Africa.³ Consistent evidence is provided by Fedderke et al. (2007), who document mark-ups twice as high among South African manufacturing firms as among U.S. manufacturing firms. These findings, coupled with relatively suboptimal regulation, suggest a higher likelihood of rivalry predation in South Africa than in the U.S.

Over the past few years, stringent efforts have been made to improve product market competition. In 1999, South Africa's Competition Board was replaced with

Rossouw et al., 2002).

²For full a review of this control process, see Kantor (1998).

³Their proxy for competition is price cost margin measured alternatively as the ratio of price to production cost; the ratio of value added to sales; and the ratio of operating income to sales.

a new Competition Commission following the implementation of the Competition Act of 1998. These steps are meant to effectively address anticompetitive practices and to promote regulatory independence (Roberts, 2008). Unsurprisingly, Fedderke & Simbanegavi (2008) note that South African manufacturing industries are becoming less concentrated.

The uniqueness of the agency problems faced by South African firms makes it worthwhile to conduct further studies regarding the relationship between leverage, competition and performance. Since the existing evidence is in respect of U.S. firms, the findings may provide a strong indication of the extent to which the disciplinary effect of leverage can mitigate the agency costs of equity in a potentially highly predatory environment.

3. Literature review

3.1. *Leverage and firm performance*

Following the seminal paper of Modigliani & Miller (1958), the study of capital structure has attracted much attention with differing theoretical predictions. Modigliani & Miller (1958) predict that, in a perfect capital market, capital structure of a firm is irrelevant to its value (hence, performance). Capital structure, however, matters for firms for several reasons, which arise mainly from the tax-deductibility of debt interest and agency theory.

Jensen & Meckling (1976) identify two main types of agency costs. The first, agency costs of outside equity, arises from the conflict of interest between the shareholder-manager and outside equity participant. As the shareholder-manager shares profits with the outside equity participant, the former has an incentive to maximise his utility by engaging in moral hazard. Such behaviour calls for increased monitoring and incentive mechanisms or contractual relations. These translate into higher costs which increase with higher outside equity participation. Hence, higher leverage has the potential to reduce costs and enhance performance. Extending this proposition, the benefits of leverage have been attributed to the discipline that comes with leverage through interest payment pre-commitments (Jensen, 1986), the threat of bankruptcy (Grossman & Hart, 1983), and the informational content of debt (Harris & Raviv, 1990).

The second type of agency costs identified by Jensen & Meckling (1976) arises from a conflict of interest between shareholders and debt holders. Shareholders find it rewarding to engage in excessive risk-taking since profits accrue to them but losses are shared proportionally with creditors. As such behaviour will be anticipated by

debtholders, the cost of borrowing to the firm may be higher.⁴ This suggests that leverage can also have an adverse effect on firm performance, especially if the firm is already highly leveraged. [Myers \(1977\)](#) extends this analysis to the case where leverage may rather lead to suboptimal investment. As debt transfers part of the benefits of investment options to the debtholders, under certain conditions, valuable investment opportunities may be rejected by the levered firm, leading to suboptimal investment and reduced market value of the firm.⁵ In another development [Stulz \(1990\)](#) shows that whilst debt financing may be a credible device in mitigating overinvestment problems, it can worsen the underinvestment problems, as regular outflows of cash to debtholders place further resource constraints on managers.

The literature extends the agency costs of debt to the conflict of interest between the firm and its stakeholders. [Titman \(1984\)](#) argues that leverage affects the likelihood of a firm's liquidation, which can be costly to both its customers and creditors depending on the firm's liquidation policy. Customers may then be willing to trade with a highly leveraged firm only if its prices are low. Also, debt holders will be more inclined to impose restrictive covenants. [Maksimovic & Titman \(1991\)](#) argue that customers, under certain circumstances, may perceive the product quality of a highly leveraged firm to be compromised, making them reluctant to transact with it. Thus, they also suggest that a high level of leverage can be detrimental to firm performance.

Based on these theories, mixed empirical conclusions have been documented. Several studies report negative effects of leverage on firm performance ([King & Santor, 2008](#); [Ghosh, 2008](#); [Bhagat & Bolton, 2008](#)), whilst others report positive effects ([Berger & Bonaccorsi di Patti, 2006](#); [Margaritis & Psillaki, 2010](#); [Weill, 2008](#)) or insignificant effects ([Phillips & Sipahioglu, 2004](#)). A few studies suggest that the leverage-performance relationship is conditional on the degree of agency problems associated with firms ([Ruland & Zhou, 2005](#); [Schoubben & Van Hulle, 2006](#)). For instance, [Schoubben & Van Hulle \(2006\)](#) show that leverage has a positive effect on quoted firms but a negative effect on non-quoted firms. Similarly, [Ruland & Zhou \(2005\)](#) find that leverage enhances the performance of diversified firms, especially small-sized diversified firms that are associated with higher agency costs. Evidence in [Ghosh \(2008\)](#) also conditions the effects of leverage on foreign market participation, noting that, for a sample of Indian firms, the (negative) impact of leverage is higher for firms with foreign debt, and that a leveraged firm's performance is more

⁴Higher borrowing costs reflect monitoring and bonding expenses.

⁵For example, when the firm is highly leveraged such that the net present value of the investment opportunity is less than debt payment to creditors.

sensitive to changes in nominal exchange rate.

Recent extensions of the literature ([Bolton & Scharfstein, 1990](#); [Chevalier, 1995a,b](#); [Chevalier & Scharfstein, 1996](#); [Dasgupta & Titman, 1998](#)) attach strong significance to product market competition in the leverage-performance relationship, since it gives an indication of the likelihood and the nature of rival firms' reaction following a firm's leverage increase.

3.2. Leverage, pricing strategy, competition and firm performance

Leverage has a complex interaction with product market competition. [Brander & Lewis \(1986\)](#) suggest that leverage permits firms to compete more aggressively in a product market due to limited liability. The strategic effect of such behaviour could offset the associated costly agency problems. [Wanzenried \(2003\)](#), however, conditions the effects on profit of such strategic behaviour on the nature of competition and product characteristics. This suggests that the limited liability effect of debt could fail to boost the profitability of the leveraged firm. Specifically, the limited liability effect of debt can lead to a decrease in profit if competition is Cournot. The reason is that limited liability induces a more aggressive production which leads to lower realised prices. The decrease in profit is higher the more substitutable the products are. Also, predation theories and related literature ([Fudenberg & Tirole, 1986](#); [Bolton & Scharfstein, 1990](#); [Chevalier & Scharfstein, 1996](#); [Dasgupta & Titman, 1998](#)) suggest that leveraged firms could suffer a significant competitive disadvantage in product markets.

Leveraged firms may be more vulnerable to predation in concentrated product markets. [Fudenberg & Tirole \(1986\)](#) suggest that, given that current period profit is a signal for future prospects in a product market, incumbent firms may have an incentive to predate on entrant firms. Such action lowers the current period profits of the entrant firms and sends incorrect signals about future prospects. As leveraged firms may be more financially constrained than their less leveraged rivals in concentrated product markets, their sensitivity to product market signals is likely to be relatively higher.

A similar argument, which does not make "signal-jamming" a necessary condition for predation, is presented by [Bolton & Scharfstein \(1990\)](#). They show that debt contracts designed to align the interest of managers to creditors often create an opportunity for rivalry predation. An optimal contract requires periodic payment by the leveraged firms to the creditors; failing this, the firm is liquidated. This contract, however, encourages rivalry predation since this can lower the leveraged firm's current period profit, making it more likely to be liquidated and exit the market. This rivalry predation continues for as long as it accrues positive net benefits for the rival firm.

In a perfect (or more) competitive industry, each firm accounts for a relatively small proportion of the market. Hence, there should be less incentive to predate in more competitive markets.

[Chevalier & Scharfstein \(1996\)](#) extend the above-mentioned model along the lines of switching cost models. They note that leverage constrains a firm's ability to invest in market shares since the fear of default restricts attention to current period performance. Consistently, they show that highly leveraged firms charge higher prices than their less leveraged counterparts during recession. This suggests that high leveraged firms are expected to have a competitive disadvantage in concentrated or uncompetitive industries, given that firms behave less competitively during recession. The magnitude of this disadvantage should decrease with the degree of competitiveness in the product market.

[Chevalier \(1995a\)](#) provides evidence in respect of the competitive disadvantage associated with leverage. In her study of the U.S. supermarket industry, she finds that an increase in leverage leads to increased market value of competitors. Also, when incumbents are highly leveraged, entry and expansion of new firms are likely. The results suggest that leverage softens product market competition. Again, [Chevalier \(1995b\)](#) shows that market prices rise following an increase in leverage if rival firms are also highly leveraged. The highly leveraged firms are found to charge higher prices than their less leveraged competitors. The reverse is true when rivals are less leveraged and markets are concentrated: prices drop as highly leveraged firms leave the market. The findings suggest that highly leveraged firms are more vulnerable to predation in product markets with less competition and less leveraged rivals.

Perhaps the most direct evidence of the interaction effects of capital structure and competition is provided by [Opler & Titman \(1994\)](#). They find that highly leveraged firms lose market share to their less leveraged counterparts during industry downturns. Particularly, they find that the lost market share is severe for firms in concentrated markets. In another development, [Kovenock & Phillips \(1997\)](#) find that leverage has an adverse effect on a firm's investment and is positively associated with plant closure. Interestingly, they find that the significance of these effects depends highly on the capital structure and concentration interaction terms, suggesting severe agency problems in concentrated markets. The fact that the evidence presented in these studies is more pronounced in concentrated product markets suggests that highly leveraged firms are more vulnerable to predatory pricing in concentrated (uncompetitive) product markets.

Recent evidence is provided by [Campello \(2003, 2006\)](#). [Campello \(2003\)](#) investigates the impact of leverage on the relative growth of firms' sales in the product market. He finds that leverage has a negative impact on relative-to-industry sales

growth of firms in relatively less leveraged industries during recession, but not during boom. This finding can be attributed to less competitive behaviour associated with macroeconomic downturns. The finding further indicates that the effects of leverage significantly depend on the severity of agency problems in the product market. This view agrees, at least in part, with his 2006 study which finds that moderate levels of debt are associated with high sales performance, whilst high levels are associated with poor performance. Particularly, he finds significantly higher effects for firms in concentrated markets compared to their counterparts in competitive markets.

It must be emphasized that, besides the predation-mitigating benefits of competition, the discipline that comes with competition (Aghion et al., 1997; Hart, 1983) reinforces the disciplining effects of leverage or mitigates the agency problems of debt. For instance, Nickell (1996) shows a positive relationship between several measures of competition and firm performance measured as total factor productivity (TFP) growth. In contrast, Aghion et al. (1997) note that fierce competition could cause firms to reduce their leverage, resulting in the reduced disciplining effect of leverage. This effect could be higher than the direct disciplining effect of competition, implying a net reduction in product market discipline. Recent work by Beiner et al. (2011) in respect of 200 Swiss firms suggests a negative relationship between product market competition (measured as HHI) and firm performance.

The review of the theoretical and empirical evidence presented in this section thus far points to appealing interactions between capital structure, competition and firm performance. It is worth emphasising that the empirical evidence taking this interaction into account is all based on U.S. data and employ concentration-based measures of competition. In what follows, the measure of and issues relating to competition are discussed.

3.3. Leverage and product market competition: Measurement issues

Whilst a few studies provide some evidence on the interaction between leverage, competition and performance, the proxies for competition may be problematic. Measuring competition normally takes a structural or non-structural approach. The structural approach infers competition from the degree of product market concentration, notably the Herfindahl-Hirschman Index (HHI) as in Campello (2006) and four-firm concentration ratio as in Opler & Titman (1994), Chevalier (1995a,b), Kovenock & Phillips (1997) and Campello (2003). Higher product market concentration is associated with lower competition and vice versa. The non-structural approach, on the other hand, derives the degree of competition from market behaviour. The preference for a non-structural measure of competition stems from the fact that higher concentration may not necessarily imply lower competition. In fact, the efficiency-

structure hypothesis notes that a high level of product market concentration could simply be the outcome of pronounced efficiency (Demsetz, 1973). In this regard, differential efficiency may cause some firms to grow relatively fast whilst for other firms efficiency may require downsizing. Likewise, Boone et al. (2005, 2007) argue that a high level of concentration can arise from strong competition forcing inefficient firms out of the market. In this sense, concentration may fail to accurately predict the degree of competition.⁶

In view of these setbacks, Boone et al. (2005, 2007) and Boone (2008) propose a new measure of competition, the Boone indicator (BI). The BI measures the sensitivity of firms' profits (or market shares) to their inefficiency in product markets. It is based on the assumption that in a more competitive product market firms are penalised severely in lost profits or market shares for being inefficient. It assumes that profits increase with efficiency and this increase is higher in more competitive industries. Thus, unlike concentration-based measures of competition, the BI does not suffer from reallocation effects within product markets.⁷ In addition to its appealing theoretical properties, the BI is simple in data requirements. Following its pioneering application by van Leuvensteijn et al. (2007) to the European banking industry, the BI has gained increased popularity in the banking literature. A similar measure of competition based on the sensitivity of a firm's profit to rival firms' strategic decisions is proposed by Kedia (2006). However, improper identification of strategic decisions, or the use of proxies such as sales makes this measure of competition most useful for identifying the nature rather than the intensity of competition. Hence, the BI is the most suitable measure of competition in this study.

In summary, evidence on the interaction of leverage and competition on firm performance is generally limited and particularly lacking for developing countries in general and Africa in particular. This work is hoped to fill in the gap. It is also

⁶For instance, consider the case of a monopoly. Here monopoly price is charged in the market and concentration is highest. Compare this to a duopoly, where firms with asymmetric cost compete under Bertrand. The efficient firm has a lower cost (c_1) compared to the cost (c_2) borne by the less efficient firm (i.e. $c_1 > c_2$). The efficient firm can drive the less efficient firm out of the market by charging a price slightly less than the latter's (i.e. $p_1 = c_2 - e < \text{monopoly price}$). Assuming this stance leads to the exit of the less efficient firm, concentration is now as high as is the case for the monopoly. However, the market price is lower than the monopoly price; the incumbent firm keeps the price below the monopoly price to keep potential entrants out of the market. Concentration-based measures fail to capture this selection effect of competition: they indicate the same degree of competition under the two scenarios.

⁷That is the reallocation of output from less efficient to more efficient firms. For a detailed review, see Boone et al. (2005, 2007) and Boone (2008)

clear that evidence provided in respect of the leverage-competition relationship uses mainly concentration-based measures of competition. For the first time, this study employs a direct measure of competition in the leverage-performance relationship.

4. Research hypotheses

Based on theoretical predictions and past empirical evidence, as well as the South African corporate context, three main testable hypotheses are formulated.

The balance between agency costs of equity and debt, emphasised by [Jensen & Meckling \(1976\)](#) tilts in favour of the latter, given the equity culture and the agency problems associated with South African firms, as well as the regulatory environment within which these firms operate. Furthermore, any increased monitoring necessitated by debt-financing ([Jensen & Meckling, 1976](#)), though costly, might be expected to reinforce the discipline that comes with leverage ([Grossman & Hart, 1983](#); [Harris & Raviv, 1990](#); [Jensen, 1986](#)). Moreover, the relatively suboptimal regulatory environment in South Africa is expected to reinforce the strategic advantage (limited liability effect) of leverage suggested by [Brander & Lewis \(1986\)](#). Thus, leverage is expected to yield a positive effect on firm performance. This effect is, however, expected to decrease at very high levels of leverage given the likely debt overhang problems emphasised in [Myers \(1977\)](#). This expectation leads to the first hypothesis:

H1: *Leverage has a nonlinear positive effect on firm performance.*

Leverage makes firms vulnerable to rivalry predation in concentrated or uncompetitive product markets, as shown in the extant literature ([Bolton & Scharfstein, 1990](#); [Campello, 2003, 2006](#); [Chevalier, 1995a,b](#); [Chevalier & Scharfstein, 1996](#); [Kovenock & Phillips, 1997](#); [Opler & Titman, 1994](#)). Given that the competitive-disadvantage of leverage may be only partially offset by the strategic benefits of leverage emphasised in [Brander & Lewis \(1986\)](#), it is expected that the benefits of leverage are improved (reduced) by product market competition (concentration). A second hypothesis is formulated as follows:

H2: *The agency benefits of leverage increase (decrease) with product market competition (concentration).*

Finally, to the extent that predatory incentives may be driven by rival firms' levels of leverage ([Campello, 2003, 2006](#); [Chevalier, 1995b](#); [Chevalier & Scharfstein, 1996](#)), a related composite hypothesis that the effects of leverage may be competitor-driven

is formulated:

H3: *High relative-to-rival leverage is associated with high firm performance which increases (decreases) with product market competition (concentration).*

5. Data

The study uses an unbalanced panel data consisting of 257 South African firms listed on the Johannesburg Stock Exchange (JSE) Limited from the period 1998 to 2009, available from DataStream. The sample selection was guided by data availability. Every non-financial firm with three or more years of consecutive observation was included.

The sample firms were classified into 8 distinct industries using the Industry Classification Benchmark (ICB), equivalent to the Datastream Global Equity Indices level 2. Firms from the financial and utility industries were excluded. These sectors consisted of firms in banking, insurance, equity investment and real estate, including investment trusts. These exclusions were motivated by regulatory differences and for the ease of comparability of results.

5.1. Firm-specific variables

The choice of variables and proxies is guided by the literature. The measure of performance is return on assets (ROA), measured as total operating profit plus depreciation and amortization (EBITDA) divided by total assets. By construction, ROA is a good approximation of the extent to which managers put firms' resources to efficient use. ROA, being an accounting measure of performance, has been criticised because it suffers from the effects of differing accounting standards. However, market measures of performance, including Tobin's Q, are not faultless. [Demsetz & Lehn \(1985\)](#) suggest that ROA better reflects current business conditions whilst Tobin's Q mirrors expected future development. In similar fashion, [Demsetz & Villalonga \(2001\)](#) argue that Tobin's Q suffers from the use of tangible assets whose depreciation falls short of their true economic depreciation. Also, they emphasise that, unlike accounting measure of performance, Tobin's Q is not independent of psychological influences. These notwithstanding, evidence points to a high degree of correlation between ROA and Tobin's Q, suggesting that either is an appropriate measure of performance ([Scherer & Ross, 1990](#)). As the study employs data from different industries and firms of varying size, the use of ROA mitigates any size bias in the

results.⁸

Leverage (Lev) is measured as total debt divided by total assets. Relative leverage (Rlev) is measured as the difference between each firm's leverage and the mean industry leverage. This is employed to control for the extent to which rival firms are less (or more) leveraged.

The research controls for other relevant firm-specific variables such as sales growth, firm size and mean earnings. Sales growth (Growth), a proxy for growth opportunities (King & Santor, 2008; Maury, 2006), is measured as the difference between sales of firm i at time t and its one-period lagged sales divided by the latter - that is, $(Sales_{i,t} - Sales_{i,t-1}) / Sales_{i,t-1}$, where the subscripts i and t indexes firm i at time t .

Firm size (Size) is measured as the natural logarithm of total assets. While large firms may be associated with a high degree of moral hazard and increased need for monitoring, they may also have the benefits of diversification and economies of scale in monitoring top management (Himmelberg et al., 1999).

Following Ghosh (2008), mean earnings (MROA) is measured as 2-year moving average of profitability (ROA).⁹

Two additional variables are also employed in this paper to serve as external instruments for leverage in order to mitigate possible bias resulting from reverse causality between leverage and profitability. These are tangible assets and non-debt tax shield. Tangibility of assets (Tan) is measured as the ratio of tangible assets to total assets. It plays a major role in firms' access to debt finance (Booth et al., 2001; Campello, 2006). This is especially so in developing countries where creditor protection and contract enforcement is suboptimal. Non-debt tax shield (NDTAX) is depreciation and amortization divided by total assets.

5.2. Competition variables

The variables used to capture competition are alternatively Herfindahl-Hirschman Index (HHI) and the Boone indicator (BI). Following Beiner et al. (2011), HHI is measured as the sum of squared market shares of each firm in a given industry.¹⁰

⁸see Lev & Sunders (1979) for detailed review.

⁹Ghosh (2008) controls for lagged values of these variables.

¹⁰Beiner et al. (2011) follow the standard measurement approach used by the Census of Manufacturers to calculate sales-based HHI as the sum of the squared market shares for the top 50 firms (or all firms if less than 50). Ideally, the calculation of the HHI should incorporate all the firms in the various industries. In this paper, data unavailability restricts the number of firms in each industry to the corresponding numbers in the sample. Hence, the actual values could be different from the 'strict' HHI. This notwithstanding, the estimated HHI should still be able to capture the

That is:

$$HHI_{jt} = \frac{\sum_{i=1}^{Nj} (Sales_{ijt} / \sum_{i=1}^{Nj} Sales_{ijt})^2}{\sum_{i=1}^{Nj} Sales_{ijt}}, \quad (1)$$

where HHI_{jt} is the HHI for industry j at time t ; $Sales_{ijt}$ represents sales of firm i in industry j at time t . Higher values of the HHI indicate more concentration and less competitive markets.

The Boone indicator is a new measure of competition based on the theoretical assumption that, in a more efficient or competitive industry, firms are punished severely for being inefficient (Boone et al., 2005, 2007; Boone, 2008). Hence, for an industry with a high level of competition, it is expected that an increase in marginal cost leads to a drastic fall in variable profits. Therefore, the Boone indicator is measured by estimating the following regression:

$$VROA_{it} = \alpha + \beta_t \ln MC_{ij} + \epsilon_{i,t}, \quad (2)$$

where $VROA_{it}$ is the variable profit (measured as sales revenue less cost of goods sold of firm i in industry j divided by its total assets; $\ln MC_{ij}$ is the natural logarithm of the marginal cost (approximated by cost of goods sold divided by sales revenue) of firm i in industry j ; and β_t is the time-varying parameter, the absolute value of which measures competition. The sign of the coefficients is expected to be negative. The higher the absolute value of the coefficients, the higher is the level of competition in the industry. Hence, BI is the absolute value of β_t .¹¹

Table 1 provides the mean values of each variable by industry. There is a considerable degree of variability in return on assets, leverage and competition across industries. The basic materials industry has the least (mean) return on assets. This industry is less concentrated and relatively highly leveraged. At the other extreme is the telecommunications industry with the highest return on assets, which is highly concentrated and generally debt-funded.

[Table 1 about here.]

Although the regression variables exhibit a modest correlation, the correlation matrix shown in Table 2 shows no evidence of multicollinearity.

[Table 2 about here.]

dynamics of competition

¹¹Thus, the coefficients are multiplied by -1 so that higher values represent higher competition.

6. Empirical model

In order to estimate the effect of leverage on firm performance, a baseline model (Equation (3)) is formulated as

$$ROA_{i,t} = \alpha + \lambda_t + \mu_i + \beta_1 Lev_{i,t-1} + \beta_2 Com_{j,t} + \psi' x_{i,t} + \varepsilon_{i,t}, \quad (3)$$

where $ROA_{i,t}$ is return on assets of firm i at time t ; α is the constant term; λ_t is a set of time dummies controlling for macroeconomic events; μ_i represents firm-specific fixed effect; $Lev_{i,t-1}$ is lagged leverage of firm i at time t ; $Com_{j,t}$ measures the degree of competition in industry j at time t proxied alternatively by the Herfindahl-Hirschman Index (HHI) and the Boone indicator (BI); $x_{i,t}$ is a set of control variables described in section 5, including the squared term of lagged leverage ($Lev_{i,t-1}^2$); and $\varepsilon_{i,t}$ is the error term. The lagged value of leverage helps address any possible reverse causality between leverage and performance. Also, the inclusion of the squared term of lagged leverage takes account of the possible nonlinear effect of leverage on performance. Likewise the effect of size is unlikely to be linear, hence warrants the inclusion of the squared term ($Size_{i,t}^2$) as in Ghosh (2008)

As pointed out in the preceding sections, product market competition is an important factor in the analysis of *leverage* and firm performance. In order to capture the effect of competition, equation (3) is rewritten to include the interaction of *leverage* and product market competition as shown below:

$$ROA_{i,t} = \alpha + \lambda_t + \mu_i + \beta_1 Lev_{i,t-1} + \beta_2 Com_{j,t} + \beta_3 Lev_{i,t-1} \times Com_{j,t} + \psi' x_{i,t} + \varepsilon_{i,t}, \quad (4)$$

where $Lev_{i,t-1} \times Com_{j,t}$ is an interaction term: the product of lagged leverage of firm i in industry j at time t and competition in industry j at time t . All other terms are as previously defined. Again, particular attention is paid to the possibility of non-monotonic effect of leverage on performance.

Differentiating equation (4) with respect to leverage and competition, alternatively, gives the following:

$$\frac{\partial (ROA_{i,t})}{\partial (Lev_{i,t-1})} = \beta_1 + \beta_3 Com_{j,t} \quad (5)$$

which is modified in all specifications involving the squared term of leverage; and

$$\frac{\partial (ROA_{i,t})}{\partial (Com_{j,t})} = \beta_2 + \beta_3 Lev_{i,t-1}. \quad (6)$$

From equation (5), when HHI is used as a measure of competition the effect of leverage on performance of firms in an unconcentrated (perfectly competitive) industry is captured by β_1 whilst $\beta_1 + \beta_3 HHI_{j,t}$ shows the effect of leverage at specified levels of concentration or competition. When BI is used as the measure of competition, however, the interpretation is reversed: β_1 captures the effect of leverage for firms in an uncompetitive industry whilst $\beta_1 + \beta_3 BI_{j,t}$ captures the effect of leverage at specified levels of competition. Using equation (5), it is possible to probe the marginal effect of leverage at specified values of HHI or BI. Using the variance-covariance matrix, the standard errors corresponding to the marginal effects of leverage can be obtained (see Aiken & West, 1991).¹² Equation (6) also shows that the marginal effect of competition on firm performance is given by $\beta_2 + \psi Lev_{i,t-1}$. Here β_2 captures the effects of competition for non-leveraged firms whilst $\beta_2 + \psi Lev_{i,t-1}$ captures the same effect for leveraged firms.

Also, in order to verify that the leverage effect is driven by rivalry predation, variants of equations (3) and (4) are estimated by replacing leverage with relative-to-industry mean leverage or simply relative leverage. For marginal effect analysis, equations (5) and (6) are modified accordingly.

All equations are estimated using panel fixed effect models. The Hausman (1978) specification test is performed in order to assess the suitability of the fixed effect models against random effect models. The Hausman (1978) test is motivated by the fact that the fixed effect and the random effect should not be different for the case where μ_i is uncorrelated with the regressors.

Finally, the study uses cluster-robust standard error estimations to control for possible heteroskedasticity and autocorrelation within firms.

6.1. Endogeneity issues

Although lagged values of (relative) leverage are used in the above models to mitigate simultaneity bias, to fully address the simultaneity issues and omitted variable bias in respect of leverage, and also measurement errors in respect of the proxies for competition, equations (3) and (4) are re-estimated using the 2-step Generalised Method of Moments (GMM) technique. As instruments for leverage, the paper em-

¹²For instance, the standard errors corresponding to these marginal effects for the model with only leverage and competition interaction term are given by $SE(\beta_1 + \beta_3 Com) = \sqrt{V(\beta_1) + 2ComV(\beta_3) + Com^2Cov(\beta_1, \beta_3)}$ where $V(\beta_1)$ and $V(\beta_3)$ are respectively the variances of β_1 and β_3 ; $Cov(\beta_1, \beta_3)$ is the covariance between β_1 and β_3 ; and Com is the specified value of HHI or BI . For models involving the squared term of leverage the formula is modified. See Aiken & West (1991).

employs tangible assets as in [Campello \(2006\)](#), and non-debt tax shield (up to two lags).¹³ The competition variables are instrumented with up to two lags of their own.

The use of tangible assets and non-debt tax shield as instruments is intuitively appealing and diagnostically satisfactory. First, tangibility of assets is a major determinant of firms' access to finance ([Booth et al., 2001](#); [Campello, 2006](#)), and its effect on performance is only through financing, making it a valid instrument for the leverage-performance equation ([Campello, 2006](#)). Second, firms with a larger non-debt tax shield are expected to have lower leverage ([DeAngelo & Masulis, 1980](#)),¹⁴ and non-debt tax shield is not expected to have a direct effect on firms' operating profits before depreciation and amortisation. This suggests that non-debt tax shield is a valid instrument for leverage. In fact, [Fama & French \(2002\)](#) provide empirical support for the inverse relationship between non-debt tax shields and the level of firms' leverage.

7. Results

7.1. *Leverage-performance relationship*

Table 3 presents the estimation results of equations (3) and (4). Models 1 to 4 are alternative specifications in which the HHI is used as the inverse measure of competition. Models 5 to 8, on the other hand, are the models using BI as the main measure of competition. Models 1, 2, 5 and 6 show the baseline results obtained from the estimation of equation (3).

The results show that financial leverage has positive effects on firm performance. These results suggest that financial leverage mitigates the agency costs of outside equity as noted in [Jensen & Meckling \(1976\)](#), particularly given the conservative use of debt among South African firms. With relatively higher use of equity finance, it is expected that the agency costs of equity will outweigh the agency costs of debt, making the agency benefits of debt much more realisable for South African listed firms. At this point, this finding is broadly consistent with the empirical evidence in [Weill \(2008\)](#) and [Berger & Udell \(2006\)](#). Controlling for the squared term of leverage (models 2 and 6) does not change the results. The coefficients of the leverage squared terms are significantly negative, implying that

¹³Lagged values of leverage are not used as instruments due to likely persistence in leverage. Persistence in financial leverage is documented in [Lemmon et al. \(2008\)](#), noting that Compustat nonfinancial firms' financial leverage exhibits very little variation over time, as its determinants are stable over long periods of time.

¹⁴Non-debt tax shields are inversely related to expected taxable profits and, therefore, the expected payoff from interest tax shields.

excessive levels of leverage may have an adverse effect on firm performance. However, given the magnitude of these coefficients, the overall effect of leverage on performance is positive.¹⁵ These findings provide support for Hypothesis 1.

[Table 3 about here.]

The results show no statistically significant effect of competition on firm performance. The results also show that most of the control variables are significantly related to performance. Consistent with [Ghosh \(2008\)](#), firm size is nonlinearly and significantly related to profitability. Thus, whilst the benefit of size (including diversification and economies of scale) may help boost firm performance, excessive expansion may make moral hazard pervasive (see [Himmelberg et al., 1999](#)). Also, growth is found to be insignificantly related to profitability. Expected return (MROA) has a significant positive effect on profitability.

The estimation results for equation (4) are shown in models 3, 4, 7 and 8. These estimations differ from the previous regressions by the inclusion of interaction terms between leverage and competition. The effect of leverage on the performance of firms is, again, positive and increases (decreases) with product market competition (concentration). Although the leverage-competition interaction terms and the squared terms of leverage are not significant when jointly included in the same model, a joint test of significance (White F test) confirms they are jointly significant.¹⁶ Hence, models 3 and 7 are re-specified without the squared terms of leverage as shown in models 4 and 8; the coefficients of the interaction terms are significant. Interestingly, concentration (competition) is significant only when interacted with leverage, suggesting the presence of predatory product market interactions which vary directly with financial leverage. The interaction term between leverage and the HHI (model 4) is negative whilst the one between leverage and the BI (model 8) is positive. These findings suggest that the benefits of leverage increase (decrease) with product market competition (concentration), lending support for Hypothesis 2.

These findings broadly provide support for a number of theoretical predictions ([Bolton & Scharfstein, 1990](#); [Chevalier & Scharfstein, 1996](#)) and evidence that suggest that increase in financial leverage is associated with predatory behaviour in concentrated (uncompetitive) product markets ([Chevalier, 1995a,b](#); [Opler & Titman, 1994](#); [Kovenock & Phillips, 1997](#)).¹⁷

¹⁵Marginal effects are discussed in detail in section 7.3

¹⁶The non-significance of the interaction term and squared term of lagged leverage may be due to high correlation between them. Correlation between these two variables ranges between 0.74 and 0.80.

¹⁷[Opler & Titman \(1994\)](#) and [Kovenock & Phillips \(1997\)](#), however, find a direct negative effect

7.2. *Relative leverage-performance relationship*

In what follows, the paper seeks to substantiate the possibility that the marginal effect of leverage is, at least to some extent, competitor-driven. Employing relative leverage, which measures the difference between a firm’s leverage and the mean industry leverage, may corroborate the existence of predatory behaviour as outlined in [Chevalier & Scharfstein \(1996\)](#) and [Bolton & Scharfstein \(1990\)](#). Additionally, this approach helps to check the robustness of the preceding results. Hence, equations (3) and (4) are revised such that leverage is replaced with relative leverage. The results are shown in Table 4.

[Table 4 about here.]

Consistent with the previous findings, the coefficient of relative leverage is positive and significant; the interaction term involving the HHI is negative and significant; whilst the one involving the BI is positive but statistically insignificant.¹⁸ Thus, the results show that firms that are more leveraged than their rivals have higher performance which increases (decreases) with product market competition (concentration), lending support for Hypothesis 3. The results are robust when taking possible non-monotonicity into account, and to alternative proxies for competition. Also, competition (the BI) is found to exert a statistically significant positive effect on firm performance. These results, coupled with the preceding findings, suggest that the disciplining effects of competition as argued by [Hart \(1983\)](#) and [Aghion et al. \(1997\)](#) outweigh the crowding-out effect of competition as indicated also in [Aghion et al. \(1997\)](#). Thus, competition has a net disciplining effect which reinforces the disciplining effect of leverage and results in higher performance.

7.3. *Marginal effect analysis*

The natural progression at this stage is to probe the interaction terms between leverage and competition in order to analyse the moderating impact of competition on the leverage-performance relationship. The models are evaluated at the mean, low (one standard deviation below the mean) and high (one standard deviation above the mean) values of the Herfindahl-Hirschman Index (HHI) and the Boone indicator

of leverage on firm performance. Also, as discussed earlier, their performance measures are different from the one used in this paper.

¹⁸Although the coefficient of the interaction term between lagged leverage and BI is statistically insignificant, it is jointly significant with the coefficient on lagged leverage.

(BI).¹⁹ Where the squared terms of (relative) leverage are involved, the marginal effects are evaluated at the mean of (relative) leverage.²⁰ Table 5 summarizes the marginal effect analysis. The first two columns show the marginal effects involving HHI whilst the last two show those involving the Boone indicator.

In Panel 1, attention is restricted to the models involving only the squared terms of leverage. This corresponds to models 2 and 6 in Tables 3 and 4. It shows that the marginal effects of leverage and relative leverage are positive and statistically significant. Similarly, in Panel 2, where the interaction and the squared terms of leverage and relative leverage are involved, the marginal effects on performance of leverage and relative leverage are positive over the relevant levels (mean, low and high) of HHI and the Boone indicator (BI). Surprisingly, the marginal effects of relative leverage with respect to HHI are significant only at high values of HHI. This might be due to the concern raised earlier about this specification. Panel 3 relates to models in which the squared terms of leverage and relative leverage are dropped. The results, again, indicate that the marginal effects of leverage and relative leverage are positive over the relevant levels of HHI and the BI, and vary directly (inversely) with product market competition (concentration).

The above findings suggest that, even though the performance effects of leverage and relative leverage depend, to a large extent, positively (negatively) on product market competition (concentration), which is consistent with the presence of significant predatory market behaviour, the overall effect is significantly positive.

[Table 5 about here.]

7.4. GMM results

The 2-step Generalised Method of Moments estimation results for equation (4) are presented in Table 6. Leverage is instrumented with tangible assets as in Campello (2006), and non-debt tax shield (up to two lags). Competition proxies are instrumented with up to two lags of themselves, with appropriate modification of the interaction terms. Appropriate test are conducted to verify the validity and relevance of the instrument.

[Table 6 about here.]

¹⁹The mean and standard deviation of Boone indicator are respectively 0.43 and 0.66. For the HHI, they are respectively 0.15 and 0.13.

²⁰The mean of leverage and relative leverage are respectively 0.23 and 0.00.

The results are similar to those presented in previous sections. As before, financial leverage is shown to have a significant positive effect on firm performance and this effect increases (decreases) with product market competition (concentration). These findings are robust to alternative measures of leverage and competition. For instance, using HHI as the inverse measure of competition (models 1 and 2), the coefficients of leverage and relative leverage are positive and significant whilst the interaction effects are significantly negative. This is consistent with models 3 and 4 where leverage, relative leverage and their interactions with the Boone indicator are all significantly positive.

The marginal effects of leverage and relative leverage are probed, again, at mean, low and high levels of product market competition (concentration). For brevity of this paper, the results are not shown here. First, the marginal effect of leverage on firm performance is positive over the relevant range of HHI. Using relative leverage instead of absolute leverage yields similar results. The results remain qualitatively unchanged when the Boone indicator is used as the proxy for competition.

7.4.1. Model diagnostics

To assess the extent to which the instruments satisfy the orthogonality condition, Hansen J-statistic is computed. The Hansen J-statistic follows a χ^2 distribution where the number of overidentifying restrictions gives the degrees of freedom. The null hypothesis is that the overidentifying restrictions are valid. Where the orthogonality condition is not satisfied, either because the instruments are not truly exogenous or the instruments are wrongly excluded from the model (see [Baum et al., 2003](#)), the null hypothesis is rejected. The p-values of the Hansen J-statistics are well above 0.1, meaning that we cannot reject the null hypothesis that the instruments are valid.

Although the instruments are valid, they could be weakly correlated with the endogenous regressors. Hence, a weak identification test is also performed by computing the Kleibergen-Paap rk Wald F statistic and comparing it with the Stock-Yogo IV critical values. The null hypothesis is that the instruments are weakly identified. As a rule of thumb, a Kleibergen-Paap Wald rk F statistic greater than 10 is required to reject the null hypothesis ([Baum, 2006](#)). As shown in Table 6, the Kleibergen-Paap Wald rk F statistics are all greater than 10. Hence, we can reject the null hypothesis and conclude that the instruments are not weakly correlated with the endogenous regressors.

7.5. Other robustness test

The study tests for the robustness of the results in various ways. Besides using different measures of leverage, and different proxies for competition, in unreported

regressions, different measures of performance (return on equity and after-tax return on assets) were also used with qualitatively similar results. In addition, the sensitivity of the results to alternative and additional control variables, including volatility of returns on assets and dividend, are analysed. The results are not qualitatively different from the above. In relation to outliers, fairly robust results are observed for models in which all variables are winsorised within 5% and 95%.²¹

8. Conclusion

In this paper, the effects of leverage on firm performance are investigated. The study further investigates the extent to which the leverage-performance relationship is influenced by product market competition. Using a panel dataset of South African listed firms, it is found that financial leverage has a significant positive effect on firm performance. Also, using the Herfindahl-Hirschman Index and the Boone indicator as alternative measures of competition, it is found that firms in unconcentrated (competitive) industries significantly benefit from leverage whilst those in concentrated (uncompetitive) industries are likely to suffer adverse effects of leverage. This notwithstanding, the marginal effect of leverage is positive across the relevant range of product market concentration (competition). Accounting for nonlinearity in the leverage performance relationship does not qualitatively alter these findings. In addition, the results are robust to alternative measures of leverage, competition, and to different estimators.

The findings of this paper have two main policy implications. First, South African firms could significantly improve their performance if there is a shift from the current conservative use of debt. Second, whilst policies aimed at popularising debt-finance to firms could have significant positive effects on their performance, the benefits of such policies would be much better realised if matched with effective pro-competition product market regulations.

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²¹The estimation results for winsorised variables are available on request.

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Table 1

Mean values of variables by industry

Industry	ROA	Lev	Size	Growth	MROA	Tang	NDTAX	HHI	BI
Oil and Gas	0.068	0.247	14.135	2.483	0.097	0.649	0.046	1.000	-0.272
Basic mat	-2.008	0.348	13.717	9.866	-1.262	0.429	0.038	0.098	0.494
Industrial goods	0.109	0.206	12.991	23.884	0.110	0.245	0.046	0.100	0.382
Consumer goods	0.124	0.166	13.500	0.177	0.127	0.304	0.031	0.126	0.773
Health care	0.160	0.303	14.391	0.440	0.168	0.359	0.026	0.410	0.510
Consumer service	0.115	0.143	13.471	1.384	0.122	0.263	0.041	0.097	0.335
Telecommunication	0.355	1.040	14.619	0.411	0.364	0.314	0.133	0.421	-0.825
Technology	0.143	0.119	11.788	0.378	0.145	0.108	0.052	0.373	0.529

This table presents the descriptive statistics for the data. The sample comprises 257 South African firms. *ROA* is total operating profit plus depreciation and amortization (EBITDA) divided by total assets. *Lev* is the ratio of debt to total assets. *Size* is the natural logarithm of total assets. *Growth* is the one-year growth rate of sales. *MROA* is 2-year moving average of return on assets. *Tang* is the ratio of property, plant and equipment to total assets. *NDTAX* is non-debt tax shield, measured as depreciation and amortization divided by total assets. *HHI* is the Herfindahl-Hirschman Index. *BI* is the Boone indicator (coefficients estimated from equation (2) multiplied by -1 so that higher values reflect higher competition).

Table 2
Correlation matrix

Variables	ROA _{<i>i,t</i>}	Lev _{<i>i,t-1</i>}	Rlev _{<i>i,t-1</i>}	Size _{<i>i,t</i>}	Growth _{<i>i,t</i>}	MROA _{<i>i,t</i>}	BI _{<i>i,t</i>}	HHI _{<i>i,t</i>}
ROA _{<i>i,t</i>}	1.000							
Lev _{<i>i,t-1</i>}	-0.044**	1.000						
Rlev _{<i>i,t-1</i>}	-0.052**	0.863***	1.000					
Size _{<i>i,t</i>}	0.159***	-0.059***	-0.101***	1.000				
Growth _{<i>i,t</i>}	0.001	-0.004	-0.004	-0.014	1.000			
MROA _{<i>i,t</i>}	0.719***	-0.340***	-0.324***	0.191***	-0.047**	1.000		
BI _{<i>i,t</i>}	0.127***	-0.025	-0.072***	-0.011	-0.000	0.095***	1.000	
HHI _{<i>i,t</i>}	0.014	0.041*	0.008	-0.078***	-0.010	0.017	-0.124***	1.000

This table presents the unconditional correlation coefficient between any pair of variables. *Lev* and *Rlev* are alternative measures of leverage, and therefore they do not simultaneously enter the same regression. The sample comprises 257 South African firms over the period 1998 to 2009. The subscripts *i* and *t* indexes firm and time. *RLev* is relative-to-industry mean leverage measured as the deviation of each firm's leverage from the industry mean leverage. All other variables are as described in table 1. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

Table 3
Relative leverage-performance relationship

Dep. var.: ROA	Herfindahl-Hirschman Index (HHI)				Boone indicator (BI)			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Lev_{i,t-1}$	0.3688*** (0.1026)	1.9436*** (0.6856)	2.0245*** (0.4104)	2.0412*** (0.4003)	0.3651*** (0.1067)	1.9398*** (0.6895)	2.0538* (1.1526)	0.6063*** (0.1467)
$Size_{i,t}$	0.4335* (0.2269)	1.1812* (0.6704)	1.1138 (0.8064)	0.9245** (0.4466)	0.4147** (0.6593)	1.1757* (0.7356)	1.2019 (0.3489)	0.6757*
$Size_{i,t}^2$	-0.0136* (0.0074)	-0.0404* (0.0230)	-0.0379 (0.0282)	-0.0309** (0.0148)	-0.0133** (0.0064)	-0.0406* (0.0228)	-0.0416 (0.0256)	-0.0224* (0.0119)
$Growth_{i,t}$	0.0000 (0.0001)	-0.0001 (0.0002)	-0.0001 (0.0002)	-0.0000 (0.0002)	0.0000 (0.0001)	-0.0001 (0.0002)	-0.0001 (0.0002)	0.0000 (0.0001)
$MROA_{i,t}$	1.0567*** (0.1069)	1.0024*** (0.1229)	1.0105*** (0.1545)	1.0302*** (0.1377)	1.0515*** (0.1007)	0.9965*** (0.1179)	0.9992*** (0.1115)	1.0100*** (0.1050)
$HHI_{j,t}$	1.0227 (0.9273)	0.4867 (1.0135)	1.0152 (1.3529)	2.0470 (1.4999)				
$BI_{j,t}$					0.1020 (0.0953)	0.0906 (0.0812)	0.1524 (0.2455)	-0.2129 (0.1606)
$Lev_{i,t-1}^2$		-0.0349** (0.0150)	-0.0237 (0.0481)			-0.0349** (0.0151)	-0.0385 (0.0298)	
$Lev_{i,t-1} * HHI_{j,t}$			-1.5044 (4.7344)	-4.311*** (1.0412)				
$Lev_{i,t-1} * BHH_{j,t}$						-0.2534 (1.1366)	1.2675** (0.5876)	
Intercept	-3.5886** (1.7896)	-8.8624* (5.0066)	-8.4840 (5.7275)	-7.3281** (3.5419)	-3.2778** (1.3973)	-8.7069* (4.7800)	-8.9004* (5.3472)	-5.1079** (2.5248)
N	2030	2030	2030	2030	2024	2024	2024	2024
R^2	0.4739	0.5164	0.5168	0.5146	0.4753	0.5177	0.5178	0.4952

This table shows the fixed effect estimation results for the effects of leverage on firm performance. The sample comprises 257 South African firms over the period 1998 to 2009. ROA is total operating profit plus depreciation and amortization (EBITDA) divided by total assets. $Lev_{i,t-1}$ is the lagged ratio of debt to total assets. $Size_{i,t}$ is the natural logarithm of total assets. $Growth_{i,t}$ is the one-year growth rate of sales. $MROA_{i,t}$ is 2-year moving average of return on assets. $HHI_{j,t}$ is the *Herfindahl - Hirschman* Index. $BI_{j,t}$ is the *Boone indicator* (coefficients estimated from equation (2)). Absolute measure of *leverage* is used in all models. Cluster and heteroskedasticity robust standard errors are shown in parenthesis. Each model includes year dummies which are not reported. ***, **, * and * indicate significance at 1%, 5% and 10%, respectively.

Table 4
Relative leverage-performance relationship

Dep. var.: ROA	Herfindahl-Hirschman Index (HHI)				Boone indicator (BI)			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Rlev_{i,t-1}$	0.3738*** (0.0999)	0.3839*** (0.1172)	2.4802 (1.8414)	1.4971** (0.6182)	0.3785*** (0.1017)	0.3890*** (0.1208)	0.4161*** (0.1334)	0.3970*** (0.1072)
$Size_{i,t}$	0.6184*** (0.2321)	0.8046*** (0.2321)	1.5665* (0.8437)	1.0598** (0.4991)	0.5809*** (0.1841)	0.7609*** (0.1782)	0.8701*** (0.2455)	0.6678*** (0.2488)
$Size_{i,t}^2$	-0.0205*** (0.0076)	-0.0270*** (0.0072)	-0.0559* (0.0312)	-0.0365** (0.0171)	-0.0196*** (0.0062)	-0.0261*** (0.0058)	-0.0306*** (0.0087)	-0.0231*** (0.0088)
$Growth_{i,t}$	-0.0001 (0.0001)	-0.0002 (0.0001)	-0.0004 (0.0003)	-0.0003 (0.0002)	-0.0001 (0.0001)	-0.0002 (0.0001)	-0.0002* (0.0001)	-0.0001 (0.0001)
$MROA_{i,t}$	1.0185*** (0.1022)	1.0083*** (0.0902)	1.0309*** (0.0427)	0.9828*** (0.1268)	1.0136*** (0.0946)	1.0051*** (0.0817)	0.9886*** (0.0791)	0.9963*** (0.0966)
$HHI_{j,t}$	1.1475 (0.9932)	1.3473 (0.9572)	0.7251 (0.8944)	1.4397 (1.3560)				
$BI_{j,t}$					0.1571* (0.0911)	0.1616* (0.0866)	0.2171** (0.1091)	0.2038* (0.1122)
$Rlev_{i,t-1}^2$		-0.0007* (0.0004)	-0.0053 (0.0050)			-0.0008* (0.0004)	-0.0010** (0.0005)	
$Rlev_{i,t-1} * HHI_{j,t}$			-5.4343 (4.5489)	-3.0135* (1.5573)				
$Rlev_{i,t-1} * BI_{j,t}$							0.2440 (0.1944)	0.1991 (0.1642)
Intercept	-4.7542** (1.8449)	-6.0788*** (1.9029)	-10.8522* (5.5845)	-7.7388** (3.7420)	-4.2922*** (1.3814)	-5.5117*** (1.3946)	-6.1530*** (1.7535)	-4.8310*** (1.7705)
N	2030	1759	1759	2030	2024	1754	1754	2024
R ²	0.4670	0.4664	0.5176	0.4921	0.4704	0.4698	0.4734	0.4730

This table shows the fixed effect estimation results for the effects of relative leverage on firm performance. The sample comprises 257 South African firms over the period 1998 to 2009. The variables and table structure are as described in Table 3. *Relative - to - industry mean leverage* ($Rlev_{i,t-1}$) is used as the measure of leverage in all models. Cluster and heteroskedasticity robust standard errors are shown in parenthesis. Each model includes year dummies which are not reported. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 5
Marginal effect of leverage

	HHI		BI	
	Leverage	Relative leverage	leverage	Relative leverage
Panel 1				
Mean lev.	2.849*** (1.005)	0.384*** (0.117)	2.844*** (1.011)	0.389*** (0.121)
Panel 2				
Mean HHI; mean BI and mean lev.	2.737** (1.256)	1.649 (1.146)	2.902** (0.240)	0.521** (0.204)
Low HHI; high BI and mean lev.	2.939*** (0.675)	2.377 (1.755)	2.735*** (0.657)	0.682** (0.325)
High HHI; low BI and mean lev.	2.536 (1.872)	0.921* (0.538)	2.952** (1.442)	0.359*** (0.103)
Panel 3				
Mean HHI; mean BI	1.382*** (0.241)	1.036*** (0.382)	1.149*** (0.391)	0.482*** (0.165)
Low HHI; high BI	1.959*** (0.380)	1.440** (0.589)	1.985** (0.776)	0.614** (0.267)
High HHI; low BI	0.804*** (0.102)	0.632*** (0.181)	0.311*** (0.037)	0.351*** (0.084)

This table shows the marginal effect analysis of the results presented in tables 3 and 4. Columns 1 and 2 respectively presents the marginal effect of leverage and relative leverage in models involving HHI whilst columns 3 and 4 present similar results for models involving BI. Panel 1 presents the results for models involving the squared terms of leverage and relative leverage without interaction terms. Panel 2 shows results for models involving the squared terms of leverage and relative leverage as well as the interaction terms. Panel 3 shows similar results for models involving the interaction terms without the squared terms. Marginal effects are evaluated at mean, low and high HHI or BI and, where relevant, at mean leverage or relative leverage. Standard errors are shown in parenthesis. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 6
Leverage-performance relationship - GMM approach

Dep. var.: ROA	Herfindahl-Hirschman Index (HHI)		Boone indicator (BI)	
	Model 1	Model 2	Model 3	Model 4
Lev _{<i>i,t-1</i>}	3.6170*** (1.2500)		0.9102*** (0.1953)	
Rlev _{<i>i,t-1</i>}		2.7851*** (0.7880)		0.7775*** (0.1315)
Size _{<i>i,t</i>}	1.0661** (0.5135)	1.2689*** (0.4865)	0.7271* (0.3880)	1.7228*** (0.6011)
Size _{<i>i,t</i>} ²	-0.0329* (0.0185)	-0.0470*** (0.0181)	-0.0277** (0.0134)	-0.0686*** (0.0224)
Growth _{<i>i,t</i>}	-0.0001 (0.0002)	-0.0002 (0.0002)	0.0001 (0.0002)	-0.0005** (0.0002)
MROA _{<i>i,t</i>}	1.0933*** (0.0565)	1.0203*** (0.0572)	0.9869*** (0.0364)	1.1432*** (0.3110)
HHI _{<i>j,t</i>}	-0.5093 (4.0577)	2.5468 (4.9214)		
BI _{<i>j,t</i>}			-0.2670 (0.4351)	1.3191*** (0.2259)
Lev _{<i>i,t-1</i>} *HHI _{<i>j,t</i>}	-7.7576*** (2.9041)			
Rlev _{<i>i,t-1</i>} *HHI _{<i>j,t</i>}		-6.5813*** (1.8485)		
Lev _{<i>i,t-1</i>} *BI _{<i>j,t</i>}			2.8172*** (0.8401)	
Rlev _{<i>i,t-1</i>} *BI _{<i>j,t</i>}				1.6438*** (0.3068)
<i>N</i>	1748	1748	1741	1492
Hansen J P-value	0.2633	0.3359	0.4398	0.2453
K-P W. F-stat	16.2652	14.9901	23.2961	2.2316

This table shows the GMM estimation results for the effects of leverage on firm performance. The sample comprises 257 South African firms over the period 1998 to 2009. The variables and table structure are as described in Table 3. Absolute measure of *leverage* is used in *columns* 1 and 2 whilst *relative – to – industry mean leverage* is used in *columns* 3 and 4. Cluster and heteroskedasticity robust standard errors are shown in parenthesis. Each model includes year dummies which are not reported. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.